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ASTR 503 : ASTRONOMY FOR TEACHERS (CRN 24589)

DESCRIPTION | OVERVIEW | LEARNING GOALS | CLASS DETAILS | STANDARDS | SCHEDULE | HOMEWORK | OBSERVING

Next offered Spring 2018: Offered by the Physics and Astronomy Department with cooperation from the Houston Museum of Natural Science For latest version of schedules, homeworks, etc please see the online page.

DESCRIPTION

Overview of stars, galaxies, and the Universe at a non-calculus level. Includes basics about the Sun. Learn how to teach astronomy concepts as specified by the state of Texas. Methods to help students master content, including lab activities suitable for K-12 classrooms and as field trips. Observing sessions at Rice campus observatory and George Observatory TBD. This course is designed for inservice and preservice science and math teachers (grades 6-12), but **is open to undergraduates considering a teaching profession.**

OVERVIEW

This course is designed for inservice and preservice teachers who wish to improve their content skills in Astronomy. This course develops astronomy concepts in a manner consistent with National Science Standards, Texas Essential Knowledge and Skills proficiencies and HISD's Project Clear, and the new Texas High School Graduation requirements. The course (coupled with its partner course ASTR 502) covers all topics in the Texas High School Astronomy requirements, but will be taught at a level accessible for teachers in middle and upper elementary schools. It will also cover all relevant astronomy topics in the new TX High School " Earth and Space Science" course.

The course also focuses on how students develop astronomy concepts and misconceptions and provides popular hands-on activities that can be used in the upper elementary and middle school grades (5-9) and also extended for high school Astronomy and Earth and Space Science. Participants use specially-developed software as part of the course and can involve their own students in many of the out-of-class activities. Main topics include the properties of light, celestial coordinates and the changes in the sky over a night and over a year; formation of stars, galaxies, and the universe; life and death of low and high-mass stars; extrasolar planets and astrobiology. The class is designed for inservice or preservice teachers. (Undergraduates considering teaching careers may take the class as part of their normal education program.)

Skills Taught: Hands-on model making, direct observation of astronomical events, simulations, conducting experiments, reading and comparative analysis - all appropriate for replication in upper elementary and middle school classrooms. Use of observation, comparison, application, analysis, and synthesis. Mathematics at the level of algebra, logarithms, exponentials, trigonometry and sine waves. Training in "Space Update" DVD and "Stellarium" software and experience in doing image processing and research on the Internet. Use of Powerpoint to create presentations. Observations at the Rice Observatory and one field trip TBD to the George Observatory.

Alignment with Texas Standards and High School Course requirements

SCIENCE TEKS

Grade Levels: 3-5 and 6-8

Strands: Properties and Patterns; Tools and Equipment; Natural World; Systems; Matter and Energy Interactions; Scientific Processes; Inquiry; Critical Thinking

MATH TEKS

Grade Levels: 3-5 and 6-8

Strands: Numbers, Operations, and Quantitative Reasoning: Measurement: Probability and Statistics

HIGH SCHOOL ASTRONOMY (TEXAS COURSE 112.48)

Knowledge and Skills:	Scientific Processes, scientific methods, use of data to make inferences
Science Concepts:	Characteristics of Galaxies, Age of the Universe, Big Bang Theory, Formation of galaxies and the solar system, Life cycles of stars, Nuclear reactions in stars, H-R Diagram, Units of measurement such as Light Year and Astronomical Unit; History of astronomy; Equation of gravitation, The Sun as a star, its energy sources (the remaining solar system concepts are covered in ASTR 502)

LEARNING GOALS

As a result of this class, the student will be able to:
1. describe and distinguish the various types of stellar and non-stellar objects: stars, galaxies, nebulae, red giants, planetary nebulae, supernovas, black holes, spiral galaxies, quasars, etc.
2. use the Herzsprung-Russell diagram to trace the Main Sequence and to show typical paths of stellar evolution.
3. use the Herzsprung-Russell diagram to determine rough ages of stellar clusters
4. use trigonometry to explain how parallax works, and calculate parallax of various objects.
5. describe the "distance ladder" and how astronomers can calculate distances to very distant objects..
6. use Hubble's law to calculate velocity from distance or vice versa.
7. understand the electromagnetic spectrum and identify common atomic lines.
8. observe and sketch stars, clusters, and galaxies in the sky and (Communication) be able to demonstrate to others.
9. distinguish between "dark matter" and "dark energy".
10. (Communication) research a NASA astrophysics mission, and make a powerpoint presentation to class.

CLASS DETAILS

Meeting times	Monday evenings, 6 - 9 pm (plus a few Thursdays and two Saturdays) January 8 through April 20, 2018
Meeting location	HBH 223, with some sessions in the campus planetarium BRK250, plus labs at the Campus Observatory (BRK 400) and George Observatory
Instructors	Prof. Patricia Reiff (reiff@rice.edu); Phone 713-348-4634; Office HBH 226; Office Hours by Appointment Adjunct Prof. Carolyn Sumners (csumners@hmns.org)
Textbooks	"Field Guide to Stars and Planets", Pasachoff, ISBN 978-0395934319 "Space Update", SpaceUpdate.com, ISBN 9781931-523530 (available from instructor); Bring laptop to class
Syllabus, Homework, and Grading	Grading: approximately 40% for two in-class quizzes; 50% for homework; 10% for observing project; no final exam. One of the homeworks will involve researching a spacecraft or ground-based Astronomy mission and making a Powerpoint presentation to the class. Schedule | Homework
University Credit Hours	3 (sorry, no stipend) To register for credit, contact Patricia Reiff (reiff@rice.edu) at 713-348-4634. You must be registered as a "Visiting" graduate student or be in the Master of Science Teaching program. (Visiting Student registration materials will be available at the first class). Undergraduate students considering a teaching career are also encouraged to enroll in this class for credit, but it may not count as an upper-division elective for a BS in Astrophysics.
Tuition/fees	Courtesy of major discounts from Rice University, the tuition is only $1200 for three hours of graduate credit for inservice teachers, plus $150 fees. Certain inservice teachers may qualify for special tuition scholarships - come to class the first evening.
Absence Policy	The lectures will be recorded for later playback through canvas. Because of the intense hands-on nature of some of the sessions, and the fact that we will observe through the campus telescope if weather permits, students should try to attend every class but no specific penalty for absences.

Honor Code	Students may work together on homework but each student shall turn in their own paper. Quizzes must be pledged as individual work and are subject to the Rice Honor Code.
Students With Disabilities	Any student with a disability that requires accommodation should contact the instructor and the Disability Support Servies. We will attempt every reasonable accommodation.

SCHEDULE : SPRING 2018 (TENTATIVE)

DATE	MATERIAL
Mon Jan 8 6:00-9:00 pm, HBH 223	Class overview; filling out of forms and pretest; installation of Space Update DVD; Overview of the Universe; Overview of the Galaxy (**BRING A LAPTOP**)
Mon Jan 15	NO CLASS DUE TO MLK DAY
Mon Jan 22	Introduction to Celestial coordinates; Motion of the Sky through the night; Changes during the year; changes from changes in latitude or location
Mon Jan 29 BRK 250 (6-9 pm)	The sky in the planetarium dome: celestial coordinates, motion of the sky at night
Mon Feb 5 HBH 223 (6-9 pm)	Properties of Light; spectroscopy; doppler shift; Universe in various wavelengths; introduction to parallax
Mon Feb 12 HBH 223 (6-9 pm)	Calculations of distances using parallax and standard candles. Small-angle trigonometry. Activity: size and distance of the Moon
Mon Feb 19 HBH 223 (6-9 pm)	Cosmology and the Expansion of the Universe; "Missing Mass"
Mon Feb 26 HMNS Planetarium (6-9 pm)	Review for Quiz 1; Birth and Life of Stars; H-R Diagram (takehome Quiz 1)
SATURDAY TBD (if clear) starting 8 pm (Backup Date TBD)	OVERNIGHT at George Observatory, Brazos Bend State Park (bring sleeping bags and floor pads)
Mon March 12 HBH 223 (6-9 pm)	NO CLASS - SPRING BREAK
Mon March 19	More on Stars: Fusion, Corona, Solar flares
Mon March 26	Death of Stars: red giants, planetary nebulae, white dwarfs
Mon April 2	Search for Extrasolar planetary systems
Mon April 9	Supernovas, neutron stars, Black Holes, wormholes and other exotic topics
Mon April 16	Class presentations, review for Quiz 2 (takehome quiz)
Sat April 21 (or 28) Engineering Quad, 10 am - 4 pm	"Reach for the Stars" Ride Science Festival (help with event)

HOMEWORK

- **Homework 1**: Stellarium activity.
- **Homework 2**: Doppler shift activity
- **Homework 3**: Distances and magnitudes activity - distances to stars, etc.
- **Homework 4**: Properties of Light activity.
- **Homework 5**: Sun and Stars homework
- **Homework 6**: Observing Project.
- **Homework 7**: Public Education Project.
- **Homework 8**: Astronomy Mission Report (counts as 12 points, including presentation). Electronic version of powerpoint file must be turned in, including movies if used. Must include at least 6 references, of which at least one must be a print, refereed, scientific journal (not just a web reference). Presentations April 16.

DOWNLOADS

- Quiz 1 review sheet
- Quiz 2 review sheet
- Topics, Terms and Formulas

OBSERVING PROJECT (homework 6)

Due: April 8, in class

- Observe at least 6 objects not in the solar system. Draw a sketch using the **JPG** or **PDF** observing form (Save it and print it from a print program, or print at 50% from your browser), being sure to note the location, telescope used, etc. Use a different page for each session. One of your objects can be the Sun (use safe techniques!)
- Be able to point out six stars and four constellations in the sky to the labbie! Have them sign your form that you pointed them out. (can be some of the same objects you observe).

Limiting magnitude: The "limiting magnitude" is the magnitude of the dimmest star you can see with your naked eye.

Field of View: Given the Moon's size in your field of view, you can estimate the field of view of the eyepiece by seeing how many Moons fit across the field of view.

Magnification: Equals the focal length of the objective divided by the focal length of the eyepiece. The Focal Length of the observatory 16 inch telescope is 4 m; of the 11-inch Celestron is 2m; of the 8 inch, 1 m.

There will be at least four evening sessions, but we get clouded out a lot, so be sure to come to the first possible session you can! Or, you can go the "George Observatory" (in Brazos Bend State Park) any clear Saturday evening. (We may do a campout, date TBD)

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